Haptic-feedback smart glove as a creative human-machine interface (HMI) for virtual/augmented reality applications

Year: 2020 | Citations: 609 | Authors: Minglu Zhu, Zhongda Sun, Zixuan Zhang, Qiongfeng Shi, Tianyiyi He

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Abstract

A haptic-feedback glove with triboelectric sensors and piezoelectric stimulators is developed for interaction in virtual space. Human-machine interfaces (HMIs) experience increasing requirements for intuitive and effective manipulation. Current commercialized solutions of glove-based HMI are limited by either detectable motions or the huge cost on fabrication, energy, and computing power. We propose the haptic-feedback smart glove with triboelectric-based finger bending sensors, palm sliding sensor, and piezoelectric mechanical stimulators. The detection of multidirectional bending and sliding events is demonstrated in virtual space using the self-generated triboelectric signals for various degrees of freedom on human hand. We also perform haptic mechanical stimulation via piezoelectric chips to realize the augmented HMI. The smart glove achieves object recognition using machine learning technique, with an accuracy of 96%. Through the integrated demonstration of multidimensional manipulation, haptic feedback, and AI-based object recognition, our glove reveals its potential as a promising solution for low-cost and advanced human-machine interaction, which can benefit diversified areas, including entertainment, home healthcare, sports training, and medical industry.